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Knowing How to Write: Metacognition and Writing Instruction

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Metacognition in writing has stimulated much research and teaching interest in the past decade. The 1980s saw a shift of attention from product to process, marked by the publication of the Flower and Hayes cognitive process model of writing (Hayes & Flower, 1980) and Bereiter and Scardamalia's (1987) comprehensive research program. Both research initiatives emphasized the differences between the composing processes of experts, or more experienced writers, and novices, or their less experienced counterparts.

From this research were derived both specific objectives for instruction and principles for designing instructional methods. Programs of research have followed traditional lines of cognitive psychology, beginning with the identification of processes of more skilled writers, construction of a tentative model, testing of the model, design of instructional applications based on the models and theories, and, finally, testing of these applications.

This chapter outlines these developments, describes the models and their components in some detail, and provides examples of how these findings have been disseminated in instructional programs. My intent is to present educational psychologists, teacher educators, and teachers with detailed descriptions and relevant information about work on metacognition and writing, so that a clear direction for instructional methodology emerges.

WHAT DO WE KNOW FROM RESEARCH?

Research centers that have supported the majority of the explorations into metacognition and writing are the Center for the Study of Writing and

Literacy at Berkeley and Carnegie Mellon University (Flower, 1994; Flower & Hayes, 1981; Flower, Hayes, Carey, Schriver, & Stratman, 1986; Flower, Wallace, Norris, & Burnett, 1993; Higgins, Flower, & Petraglia, 1992; Peck, Flower, & Higgins, 1995; Penrose & Sitko, 1993), the Ontario Institute for Studies in Education (OISE; Bereiter & Scardamalia, 1982; 1987; Bracewell, 1983), and Michigan State University Center for the Institute for Research on Teaching (Englert, Raphael, Anderson, Anthony, & Stevens, 1991). Most of the work reported in this chapter was developed in these centers. In the United States, instructional principles and methods have been developed primarily in The National Writing Project, headquartered in the University of California at Berkeley, a long-term effort presently comprising about 120 national programs. Both primary research and instructional applications were addressed by OISE, where work is currently being conducted on a Computer Supported Intentional Learning Environment (CSILE), described later in this chapter. The Michigan State Center supported Cognitive Strategy Instruction in Writing (CSIW), a 1-year project with an emphasis on cognitive instruction and metacognitive learning.

Researchers in writing have generally followed the definitions of metacognition initiated by Flavell and Wellman (1977) and elaborated by Brown (1987). These definitions include knowledge of the task and one's own cognitive resources, and monitoring, or the ability to control and regulate one's own thinking. In addition, two content areas of knowledge are discriminated: (a) *process knowledge*, such as setting goals, evaluating goal progress, and making necessary adjustments; and (b) *product knowledge*, such as awareness of text types, structures, and organization. Process research makes distinctions between declarative or factual knowledge and procedural or strategic knowledge. Process cognitions include beliefs about competence, motivation, affect, and strategies. Product knowledge includes not only knowledge of models, paragraph development, and sentence development, but, increasingly, the function and purpose of a text in a defined social context, written for a specific purpose and particular audience.

Conceptually, writing is closely linked to reading, and some research in writing instruction resembles work on metacognition and reading. The two activities obviously inform each other. Writers read their texts and often construct texts from sources that they have read. While reading their own texts during composing, they exhibit the same moves as when reading the texts of others, such as backtracking to aid comprehension and building a representation in memory. This granted, the primary focus of writing research has been on the production of texts rather than on their comprehension. The one area where the two activities interface most notably is in

revision, particularly revision involving peer review or editing. This research is reviewed later in the chapter.

Reading research and writing research blend to inform some instructional applications. For example, Bereiter and Scardamalia's (1987) procedural facilitation (described later in this chapter) is designed to reduce the load on short-term memory, as is Flower's (1994) collaborative planning. Both methods resemble reciprocal teaching of reading (Palincsar & Brown, 1984), in which demands on short-term memory are reduced through the use of verbal cues and/or partners to assume the function of monitoring text planning and organizing. In such ways, reading and writing are closely related in research and instructional design, just as they are in construct, mental activity, and school curricula.

Models of the Writing Process

The most frequently cited model of composing processes results from the Flower and Hayes (1981) research into the writing of experts and novices. From think-aloud protocols, Hayes and Flower (1980) discriminated three major processes, which they call planning, translating, and reviewing (see Fig. 5.1). This empirical description closely resembles earlier theoretical work into the "stages" of writing classified as prewriting, writing, and rewriting (Rohman, 1965). However, the Flower and Hayes model modifies and specifies the crucial processes in two important ways. First, interactivity is emphasized. Symbolized by the arrows in the visual representation of the model, interactivity shows that writing is a recursive rather than a linear process, a finding that had been suggested by early process research (Emig, 1971).

The second important way in which the Flower and Hayes model specifies the writing process is its explicit identification of subprocesses. The planning process includes three subprocesses: *goal setting*, *generating*, and *organizing*. The three subprocesses are also highly interactive and may come into play at any time during composing. Goal setting includes both establishing a purpose and short-term goals, such as providing an example. Generating describes development of ideas and content, whereas organizing refers to how writers arrange their content into a coherent structure. *Translating* is the Flower and Hayes term for transforming ideas into written text. Working memory is consumed by this process, but with practice, translating can become more automated.

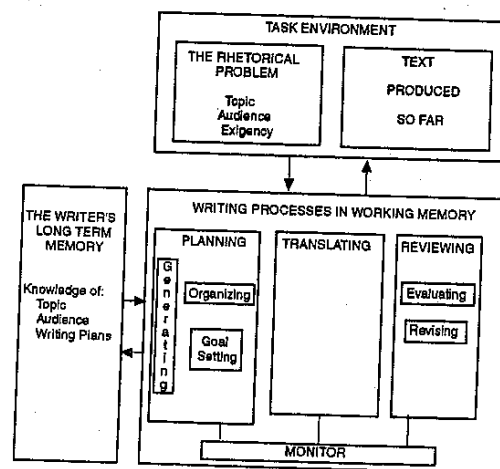


FIG. 5. 1. The Hayes and Flower model of the writing process. From *Cognitive Processes in Writing* edited by L. W. Gregg and E. R. Steinberg, 1980, Hillsdale, NJ: Lawrence Erlbaum Associates. Copyright ©1980 by Lawrence Erlbaum Associates. Reprinted with permission.

Reviewing is the process in which writers reexamine what has been written and compare it to their internal representation of intended text. The two subprocesses identified here are evaluating (comparing the text to criteria) and revising (the rewriting and restructuring of text). The identification of a monitor to manage these processes is crucial to metacognitive research, because the monitor represents the conscious control and regulation of processes exercised by the writer. Because processes are recursive, planning may be invoked during editing, or reviewing may serve to help organize. The monitor represents metacognitive awareness of how and when to invoke strategies appropriately.

In their exploration into the composing processes of both young and older children, Bereiter and Scardamalia (1987) distinguish two modes that discriminate between experts and novices: *knowledge-telling* and *knowledge-transforming*. Distinguishing a "psychology of the natural," from a "psychology of the problematic" (p. 5), the two modes attempt to account for the texts habitually produced by younger and older children.

Knowledge-telling results in a plan and a text that is primarily a list. Calling on linguistic resources derived from the ordinary social experience of conversation, knowledge-telling is an easily acquired writing strategy used by novice writers who simply recite what they know about a topic in a relatively free associationist manner. The process talk of such a writer is marked with verbalizations, such as "What else can I say?" The model can be accurately used to describe developmental changes, with 10-year-olds

consistently conforming to the knowledge-telling model and 12-year-olds beginning to show signs of conceptual planning.

Knowledge-transforming enables the writer to "accomplish alone what is normally accomplished only through social interaction—namely the reprocessing of knowledge" (Bereiter & Scardamalia, 1987, p. 5). Knowledge-transforming is a strategy demanding mental effort, engaging the writer in metacognitively guided planning, audience considerations, problem solving, and diagnosing. What distinguishes these more mature patterns is that they involve conscious control over parts of the process that are ignored by the less mature writer. This distinction provides an important principle for analyzing patterns of development and in designing instruction.

Furthermore, Bereiter and Scardamalia (1987) use the term *procedural facilitation* to describe "routines and external aids designed to reduce the processing burden involved in bringing additional self-regulatory mechanisms into use" (p. 253). These simplified routines are introduced as external supports, usually in the form of cards with statements prompting children to reconsider their text (e.g., "People won't see why this is important" or "I'd better say more"). Designed as methods that will help children acquire rules through their own activity, the prompts need to be gradually incorporated into the students' own processes.

Expert-Novice Differences

Whereas little discrimination between skilled and unskilled writers can be made on the basis of intelligence, academic achievement, or motivation, distinction can be identified in a number of process areas and in knowledge of text structure (Benton, Glover, Kraft, & Plake, 1984). For example, skilled and unskilled writers at the same grade level differ in the amount of writing they have been required to produce in academic settings, with more skilled writers required to write more (Mazzie, 1987).

While planning, experienced writers appear to be able to translate high-level goals into subgoals and to develop strategies for handling the overload on working memory by embedding solutions (B. Hayes-Roth & F. Hayes-Roth, 1979). The generation of subgoals appears to be dynamic rather than pre-established (Matsuhashi & Gordon, 1985), so that the end product is more likely to be surprising to an experienced writer than to a novice. The planning episodes of more experienced writers consider larger rhetorical elements such as overarching purpose, audience needs, and genre conventions (Bereiter & Scardamalia, 1987; Flower & Hayes, 1981).

Revising, likewise, appears to differ between more and less experienced writers. Experienced writers are better at both detecting and diagnosing problems in texts written by others (Flower et al., 1986) and in texts of their own making (Sitko, 1992). Less experienced writers define revision as word and sentence-level change (Matsuhashi & Gordon, 1985; Nold, 1981; Sommers, 1980), and although they can be taught to look for other text difficulties, less experienced writers often decide to leave potential problems in their texts (Fitzgerald & Markham, 1987; Sitko, 1992).

Editing, which was the emphasis of many school writing curricula prior to the influence of cognitive psychology, is often represented in the form of sentence correction exercises. Young writers commonly report seeking adult help while editing, most often from older family members (Raphael, Engleler, & Kirschner, 1989) rather than from instructors. Their exaggerated attentiveness to this step may be a natural adaptation to the school context, particularly the feedback they receive and the instructional emphasis on assessment (Applebee, 1984). Older writers and writers in nonschool contexts, in comparison, establish a variety of personal purposes for writing, take into account the needs of different readers, and take advantage of conventions of the genre they have selected.

In summary, inexperienced writers fail to search their memories or their environments for help in generating content; they organize what they write primarily into lists; they do not identify audience as a crucial rhetorical influence on their purpose and goal, nor do they review globally or consider reader needs as criteria for rewriting. They appear to lack awareness that memory search, organization guided by purpose, and attention to the readers are required for effective writing. Heightening awareness of these specific areas has guided instructional strategy design and research.

Methodologies and Their Impact

Writing research methodologies have followed the patterns established in cognitive science and in educational psychology. Most notable are the introspective methods of think-aloud protocols and interviews, which were developed first as research methodologies and have now become part of instructional design. Instructional design researchers have taken into account the cautions about introspective methods but have found these methods to be the most practical techniques, both for identifying primary processes and for studying the effectiveness of instructional applications. Researchers often note the positive effect on instruction of thinking aloud as a form of self-talk. All of the studies reported here use introspection, online thinking aloud protocols, retrospective interviews, or questionnaires.

Researchers are appropriately cautious about their conclusions, noting that measures of reflective talk can be misleading. Reflective talk is likely to occur under difficult or unfamiliar task conditions. When all is going smoothly, heightened awareness helps us to keep track of goals and progress, and we may not need verbal reflection (Flower, 1994). But as researchers incorporate reflective talk in the design of instructional strategies, they note that, in general, students do what they say (Raphael et al., 1989; Sitko, 1992).

Thus, methods of cognitive research, verbal protocols, and retrospective interviews have become significant tools in the design of instruction. The following section on instructional strategies shows that the most common method for describing writing process strategies is verbal thinking aloud, either modeled by a teacher or monitored by a trained conversation partner. Modeling is used to demonstrate how to plan, invoke a wide range of search strategies, mentally rehearse ideas and images, talk with others to gain information, and use planning methods such as brainstorming or freewriting to generate content.

HOW DOES STRATEGY INSTRUCTION WORK IN THE CLASSROOM?

In the previous section, I discussed findings from research into the processes of less experienced (novice) and more experienced (expert) writers. Comparison of the two kinds of writers, using the Flower and Hayes model, yields several points at which strategic instruction can be designed. Experienced writers have a repertoire of strategies, a large "tool box," from which to draw appropriate actions. Younger and less experienced writers have not yet developed this repertoire, and may even have mistaken notions of how writers work. Thus, the principles underlying strategy training for less experienced writers include reducing the load on the writer's short-term or working memory, redefining tasks, and aid in setting goals and subgoals. Educational interventions and writing curricula must be designed to cue appropriate strategy use related to planning, drafting, revising, and editing.

The assumptions that underlie strategy training in writing are restatements of the Flower and Hayes model applied to instruction. First, writing is a complex process that must be regulated by writers themselves. The high level of interactivity among the subprocesses argues for considerable "artfulness" in managing them. Second, planning involves self-questioning strategies designed to identify an audience, determine purpose, activate

background knowledge, and organize brainstorming ideas. Third, drafting involves gathering ideas generated in planning, translating them according to audience and purpose, including and expanding relevant ideas, and discarding irrelevant ones. And last, revising involves reading from the point of view of the intended audience and purpose, making and executing plans to add, delete, substitute, and modify text. All of these activities receive the attention of experienced writers, and all are apt targets for instruction. In addition to needing practice in the activities, students need writing curricula that cue these activities appropriately for their age and for their work in progress.

It should be evident that writers themselves must develop metacognitive knowledge and strategies for planning, organizing, drafting, revising, and editing. Strategy instruction is considered metacognitive only when it actively engages students in understanding their own learning (Bereiter & Scardamalia, 1987; Brown, 1987; Flower, 1994). Instruction in metacognitive awareness and control of writing has focused on cognitive processes, specifically, planning and revising, on text structure knowledge, and on the social context.

Where Should Strategy Instruction Begin?

Before looking at actual interventions, it may be instructive to pause a moment to consider what beliefs and practices students may need to "unlearn." Research into school writing practices has unearthed some discouraging findings, indicating that students have much to unlearn and that schools provide little incentive to develop writing expertise. Applebee's (1984) extensive study of writing in American schools echoes the findings of a similar earlier study in the United Kingdom (Britton, Burgess, Martin, McLeod, & Rosen, 1975). Most of the writing done by students is designed to convince the teacher that they have learned content that has been presented. The form of this writing is often a short-answer response on a test. Writing of even paragraph length is rarely demanded, and when it is, it is usually produced in one class period, first and final drafts included. Summary is called for, not analysis. Assessment practices appear to penalize students who make unsuccessful attempts at more difficult analytic tasks as opposed to practicing the easier and more familiar patterns. Although students successfully learn popular school formats such as the book report and lab report, they appear to learn a formula for producing writing for different classes and write for an audience of one, the teacher.

Applebee's study does not present a wholly bleak picture; it also provides some positive indicators of student learning ability, many of which reflect

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research on metacognitive learning. Students appear to be efficient language learners, able to vary their processes to meet the demands of different contexts and different teachers. For example, revisions become more frequent as writing becomes more demanding, and more experienced writers build arguments around a small number of points where the less experienced provide a single long list. Younger students master the narrative form early and successfully embed it in assignments that call for analysis. Students ask for feedback and help, notably from family members. To some extent, then, students naturally control and regulate how and when they use strategies. Instruction in new or unfamiliar strategies can be enhanced by helping them imagine the conditions under which they would use the strategy and helping them reflect on how they might evaluate its usefulness and incorporate what works for them.

Two Extended Examples of Metacognitive Instruction

Applebee's (1984) list of needed skills coupled with the extensive list of unproductive habits may be daunting, but several lines of instructional research are addressing aspects of these problems. Two extended examples, one from elementary education and one from secondary, will serve to illustrate the complexity of writing instruction based on metacognitive learning. The two studies are similar in joining knowledge of text structure to knowledge and practice of writing processes.

Cognitive Strategy Instruction in Writing (Englert et al., 1991) emphasizes cognitive instruction and metacognitive learning through combinations of strategies. Principles that underlie the development of instruction are an emphasis on the role of dialogue in writing development (Vygotsky, 1978; Wertsch, 1980), scaffolded instruction (Tharp & Gallimore, 1988), graduated questions, and procedural facilitation (Bereiter & Scardamalia, 1987), and transforming solitary writing into a collaborative activity (Nystrand, 1989). The program employs direct explanation of writing strategies and modeling of their use, daily writing with topics usually selected by students, use of procedural facilitation in the form of think-sheets, peer review and feedback, frequent writing conferences, and publication of student papers.

Englert et al. (1991) evaluated the effectiveness of these instructional features coupled with the development of students' knowledge of the writing process and the role of expository text structures. The study involved 183 students in Grades 4 and 5 at 12 schools. Students were drawn both from regular programs and from learning disabled programs and were randomly

assigned to control or strategy instruction groups. A posttest required students to write an explanation, a comparison-contrast, and a third paper on a self-selected topic exhibiting their own expertise. Results indicated that the papers of the cognitive strategy group were superior to the control group when judged holistically and by primary trait (a method in which characteristics of the particular genre are assessed). Readers found that the cognitive strategy writers were also more sensitive to audience needs, wrote better expertise papers, and could describe their planning, writing, and revision processes more explicitly.

In a study that compared the effectiveness of analyzing models versus procedural instruction, Smagorinsky (1991) instructed high school students on how to write definitions and also provided either general writing strategies or task-specific procedural knowledge. The study was based on two premises. First, writing requires knowledge of and control of many kinds of tasks, text structures, and procedures. Second, traditional writing instruction often emphasizes the study of models, well-written exemplars of a particular genre or paragraph structure, such as comparison-contrast or explanation.

Thus, Smagorinsky set out to compare the effectiveness of declarative knowledge of form alone with declarative knowledge of form plus either general procedural knowledge or task-specific procedural knowledge. All groups were taught the elements of a definition (criteria, examples, and contrasting examples) through study of an essay. The models group studied, labeled, and evaluated additional models of definition essays, were provided criteria and exemplars, and evaluated a series of definitions. The general procedures group was taught freewriting and brainstorming to generate the elements of a definition, plus strategies for revision and peer feedback. The task-specific procedures group was taught specific procedures of studying problematic examples to generate the elements of a definition, plus strategies for revision and peer feedback.

Qualitative and quantitative analysis of think-aloud protocols generated during the posttest showed that the group taught task-specific procedures scored significantly higher on two measures: purposeful composing and critical thinking. That is, writers in this group were better able to integrate their ideas purposefully and to anticipate readers' needs than writers in the other two groups. General procedures of brainstorming and freewriting also were more effective than the study of models alone. Smagorinsky (1991) notes that, although the study of models is a common educational practice, students have trouble teaching themselves how to write in the fashion of the exemplars. Students neither learned the structure of a definition nor

thought clearly about the ideas they generated. Clearly, although more class time is required, teaching students general prewriting strategies produces better learning than study of examples alone.

Writing Process Interventions

Planning With Procedural Facilitation. The development of planning abilities appears to be aided by procedural facilitation, which Bereiter and Scardamalia (1987) describe as explicit guides designed to reduce the strain on working memory and encourage a range of activities such as goal setting and problem identification. Although these guides are designed to pull students beyond thinking about what to write, younger children (below age 12) will tend to circumvent their intent and turn the cues into opportunities to generate more text content. Older children and adults, however, respond to facilitations in the form of cards, verbal cues or computer-generated prompts. The Englert (Englert et al., 1991) study cited earlier employed several types of procedural facilitations. Procedural facilitation used in either personal or computerized tutoring has been shown to improve writing (Beach & Eaton, 1984; Burns & Culp, 1980; Daiute & Kruindener, 1985; Florio-Ruane & Dunn, 1987; Scardamalia, Bereiter, McLean, Swallow, & Woodruff, 1989; Zellermyer, Salomon, Globerson, & Givon, 1991).

Collaborative Planning. Although most educational interventions that involve collaborative planning have a duration of a few weeks or several papers, some longer projects have been initiated. Flower (1994) reports on a course, *Cognition and Rhetoric*, built on readings about cognition and students' self-observations of how they learned and reflected on a variety of process techniques.

The primary strategy used in this course was the Planner's Blackboard (see Fig. 5.2). Drawn from the Hayes and Flower (1980) research, the planner uses the metaphor of postings on a chalkboard to draw students' attention to elements typically lacking in learners' representations of the writing process. In addition to content generation, specific elements addressed are audience, genre, conventions, and key point or purpose. Students worked alone at first and later with a partner who functions as a monitor of the planning conversation, eliciting verbal responses and guiding consideration of all rhetorical concerns.

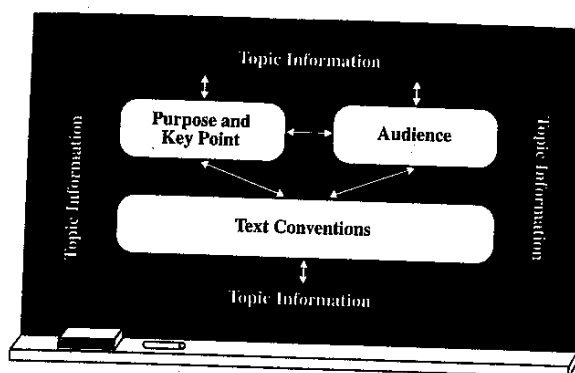


FIG. 5.2. Planner's Blackboard for developing rhetorical plans. Figure from *Problem-Solving Strategies for Writing, 4th Edition*, by Linda Flower, copyright © 1993 by Harcourt Brace & Company. Reproduced by permission of the publisher.

Results show that writers' reflective statements can be clustered into three areas: affect (including attitude, motivation, emotion, and self-image); context (including history, assumptions, and rhetorical situation); and cognition (including goals, strategies, and metacognitive awareness). Affect, context, and cognition interrelate in different ways at different times in the reflections of the students. For example, students might focus on the cognitive dimension of the map (goals, strategies, intentions, and decisions) while building representations that include affect (being "discouraged and frustrated" at their inability to assign causes to their writing problems) and using social context (their partners' collaboration or conversations with friends) to gain insights.

However, an important caution about reflection is raised in a related study. Reflection, although an important metacognitive outcome, cannot be assumed even when collaborative planning conversation is emphasized and when peers provide a challenging communicative context. Writers' awareness may be raised by working through an intellectual problem with partners, but writers must also evaluate and make decisions about their own thinking (Higgins, Flower, & Petraglia, 1992). Writers might learn to take critical positions on their own ideas by explaining and defending them in the presence of a responsive audience, but Higgins, Flower, and Petraglia's research raises questions about the surety of this outcome.

Looking for how students critically reflected on their own ideas, and whether critical reflection resulted in better writing plans, the authors examined the collaborative planning of 22 college freshmen for explicit evaluation of plans, consideration of alternatives, or justification of suggestions. After coding the transcripts for reflective comments and having them

rated holistically for quality, the researchers found a significant correlation between amount of reflective conversation and the quality of writing plans: Students used reflection in metacognitively defensible ways to identify problems, to search for and evaluate alternative plans, and to elaborate and justify ideas. But, they also found that collaboration did not guarantee reflection. Some sessions contained no reflective comments, and some students used collaboration in a way that undermined reflective thinking. The authors concluded that some students' mental representations of collaboration and of the writing assignment may resist influence by instruction.

Revising. Revising practices differentiate clearly between less experienced and more experienced writers (Flower, Hayes, Carey, Schriver, & Stratman, 1986; Matsuhashi & Gordon, 1985), and thus, revising has been targeted by several kinds of strategy instruction. Fitzgerald and Markham (1987) provided direct instruction in revision, explicit practice in detecting where readers might have difficulty, and decisions about where to add or delete text. Writers were two groups of sixth graders, one receiving four 3-day instructions in revision, the other reading good literature. The experimental group was taught how to detect where a reader might have difficulty, as well as how to add and delete information. Reviewing in order to detect differences between intended and instantiated texts intensifies control over the meaning of the text and provides an important metacognitive awareness. Making decisions about whether to elaborate or delete information likewise locates control in the author. Thus students' awareness of how they might improve texts through the revising process was heightened. Revised drafts of this experimental group were judged higher in quality than those of the control.

Revising with procedural facilitation simplifies the processes of reviewing by reducing them to three actions: compare, diagnose, and operate. In one reported experiment (Bereiter & Scardamalia, 1987), 90 children ages 10, 12, and 14 used cards with statements representing phrases that specified the three processes needed for revising text: compare, diagnose, and operate. The procedure of writing a sentence, then stopping to evaluate using one of the phrases, was modeled to show how goal-directed planning is guided by a mental representation of text and audience. Results indicate that children revised more than they had previous to instruction and that they claimed to find writing easier. Evaluations of the text quality were less conclusive, with changes for the better outnumbering changes for the worse, but overall quality showing no difference.

College freshmen are more likely to think of sentence and word-level changes than global meaning changes when asked to revise. An example of a well-focused instructional intervention is the Wallace and Hayes (1991) work on teaching global revision. In this study, one group received 8 minutes of instruction on global revision and another was simply asked to revise a passage. The texts written by students who received the instruction were judged both to be of significantly better quality and to have included significantly more global revision. Wallace and Hayes had discriminated several sources of possible difficulty in younger students, inappropriate task definition, the lack of essential revision skills, as well as the lack of executive or monitoring procedures. Their results appear to confirm their hunch that inappropriate task definition was the culprit.

A related approach to revising and editing a text globally is provided by Schriver (1993), who demonstrates varying ways in which students can learn both to redefine revision as global, whole text, rhetorical, organizational change and to review texts considering the needs of readers. Students assigned the task of revising a nature conservancy brochure on bird-watching quickly discovered, through think-aloud protocols by both experienced and inexperienced bird-watchers, that readers had different needs, were looking at different parts of the text, and were more affected by global features than students had anticipated. Schriver designed a list of prompts to focus students' attention sequentially on whole-text, sections, paragraphs and transitions, sentences, and words. Metacognitively, the method functions to help students discriminate among a variety of possible text problems and attend to them appropriately. By first considering a text globally and rhetorically, from the point of view of the readers' needs, and by later looking at the details of local revision, students can reduce the demands on cognitive resources and carry out multiple revision tasks more efficiently.

Revising With Feedback. Interpreting feedback in order to make decisions about revising is a striking example of metacognition. Writers have to attend to and arbitrate significant and sometimes conflicting voices. The task requires that they construct, out of their own previous understanding of what they wrote and out of their readers' understanding, yet another version of their task and their text. How can teaching help them heighten conscious awareness of the metacognitive task of interpreting the feedback?

Sitko (1993) designed an educational intervention to help students perceive their own texts in new ways and revise appropriately. The intervention used peer collaborative partners, a method called interpretive reading to provide writers with an "online" hearing of readers' constructive

processes, and instruction in how to make conscious decisions about revising. Interpretive feedback requires readers to work through a text aloud, stopping periodically to summarize the point and make a prediction about what is likely to come next. This reading provides the writer with a firsthand observation of how readers build a mental representation of a text, as well as how they use textual signals to guide understanding. Thus, writers can test whether their written texts are understood by readers in the same ways as they are represented in the writers' minds. A second instructional element important to the study is designed to show that using feedback to make productive decisions is not an automatic process, but one that embeds a series of smaller decisions, from understanding the feedback to setting a goal. A decision tree abstracted from think-aloud protocols acts as a metacognitive aid in helping writers consider appropriate alternatives (see Fig. 5.3).

Results of several studies (Sitko, 1992) suggest that, given peer feedback in the form of interpretive reading and the metacognitive support of a decision tree as they revise, writers made more "expert" decisions about texts (i.e., revising globally, reorganizing information, and adding appropriate information for readers). Further, both protocols and the interviews suggest that writers learned to consciously represent a broader range of options, test their observations by experimenting with alternative texts, and report the results of their experiments as conscious learning.

When feedback takes the form of a conference with a teacher or tutor, the social context becomes more complex, implicating the relationships of the participants, their respective representations of the task, their goals, and their differing strategies. Social balance must be maintained in this context if teachers are to support and not usurp students' authority over their goals and texts (Bowen, 1993). Conferences provide unique opportunities for reflecting on students' metacognitive awareness of the decisions that underlie writing, with questions such as "How did you decide to start the piece in this way?" and "What other relationship could you establish with your readers?"

The results of these studies of revision with feedback suggest that age-appropriate interventions can be sequenced in instruction to help students develop skills effectively. Young children can be taught how to elicit feedback that educates them about their readers' understanding. Older students can learn to focus attention on the information contained in feedback as an aid to informed decisions. Cumulatively and over time, curricula that help students to understand how readers interact with text can further their revision skill.

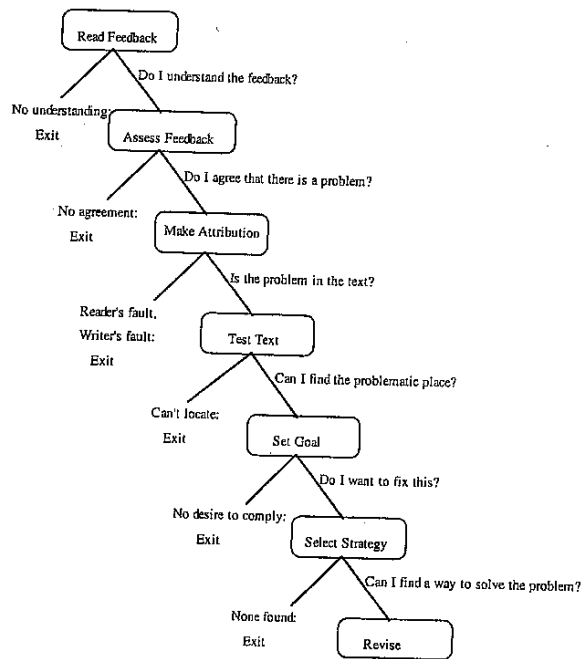


FIG. 5.3. Decision tree of revising after feedback. From *Hearing Ourselves Think*, edited by Ann Penrose and Barbara Sitko, copyright © 1993 by Ann Penrose and Barbara Sitko. Used by permission of Oxford University Press, Inc.

Computer-Assisted Writing. A computer-assisted writing partner is a special kind of procedural facilitation built to reduce memory overload and guide writing processes. Computer-assisted writing is designed specifically for the writer who may lack the necessary memory capacity to mentally represent and may also lack effective metacognitive strategies for memory search to support higher order planning.

Zellermayer et al. (1991) tested the general hypothesis that ongoing computerized procedural facilitation with strategies and writing-related metacognitions during writing would improve learners' writing. Planning prompts consisted of audience and planning questions (e.g., "Do you want your composition to persuade or to describe?" and "Are you writing for a reader who's an expert on this topic, or for someone that may need some basic facts?"). Drafting prompts asked the writers to add more, explain, or move ideas; and revision prompts requested that writers reread looking for supporting information. One group of high school

students wrote five essays with unsolicited guides presented by a computer tool (the Writing Partner); a second group received the same guidance but only when invoked by the writer; and the third group received no guidance and wrote with only a word processor. The group that was provided with automatic prompts wrote better essays and could describe their processes more explicitly than could the other two groups. The authors suggest that the unsolicited prompts focused the attention of the writers more specifically and engaged them more closely in the metacognitive activities of goal-directed planning, diagnosis of gaps between the writers' mental representation of the text and the text produced so far, and evaluation of ways to close the gap.

Instructional Costs and Benefits

Teachers who have instructed metacognitive strategies note that they typically require more class time than other types of instruction. Smagorinsky's (1991) intervention for example, required 12 days of instruction. Scardamalia and Bereiter's (1983) procedural facilitations, executed during class time, required not only the writing time but also the time needed to process the questions and prompts. Collaborative planning requires conversational space and time. Moreover, results are not always immediately apparent, with little demonstrable difference in a single paper. Thus, educators find themselves having to make a considerable commitment of time to insure the needed practice before they see improvement.

Metacognitive instruction does demand more of teachers. Instructional planning time is needed for teacher analysis of tasks, both in terms of the knowledge needed and procedures required. However, there is help available. Bereiter and Scardamalia's (1987) suggested steps for task analysis and designing a procedural facilitation follow a cognitive processing approach that both simplifies the task and reduces the information processing load. The method requires, first, identifying a self-regulatory function missing from novice process, such as whole text revision (Nold, 1981) or planning (Flower & Hayes, 1981). Second, the function is described as explicitly as possible in terms of mental operations. For example, revision can be described as comparing, diagnosing, choosing a revision tactic, and generating alternatives. The third step is to design a method of cueing the beginning and end of the process with minimal demands on mental resources. The fourth step is to design external supports such as cards or teachable routines for reducing the information-processing burden of the mental operations.

Also, as the corpus of methods emerges from research on metacognitive instruction and becomes available to educators, individual teacher planning time commitments are reduced. These methods will increasingly become available as they enter the mainstream of textbook curricula. Further, students can be assured that their cumulative repertoire of appropriate strategies will continue to build with each year of instruction. Thus, consistent and careful attention to metacognitive learning will, in the long run, save instructional time. The success of the National Writing Project in creating realistic contexts for writing in the classroom, from purposeful communication to publication for one's peers and wider audiences, bodes well for the future of metacognitive instruction.

HOW DOES STRATEGY INSTRUCTION WORK IN OTHER CONTEXTS?

Making Thinking Visible

The restrictions of the school context, noted by Applebee (1984), can militate against students' experiencing real writing and accumulating the repertoire of strategies needed for life situations. One project that expanded classroom walls, provided for community-based cooperation, and resulted in powerful theory building on the part of participants is the Making Thinking Visible Project (Flower et al., 1993). This experiment in metacognition embedded collaborative planning in an educational cooperative of 32 educators: teachers in Pittsburgh middle and high schools, faculty in community colleges and universities, and community literacy leaders. The cooperative shared ongoing education in writing, collaborative planning, and classroom inquiry; developed writing across the curriculum; became authors and audience for ongoing discovery memos; and cooperated in extensive classroom research.

One of the metacognitively rich sources of information in this study was the discovery memo. These reflective papers captured students' awareness of their own learning, particularly how they connected collaborative planning with their ongoing growth in composing. Students report learning how to use planning decisions, selecting information to support their points, applying their personal purpose as an organizational principle, considering alternatives and making conscious choices, and elaborating ideas with specific detail and examples. Teachers, who also wrote discovery memos to share with each other and the researchers, reported witnessing growth in important verbal skills, such as listening, questioning, answering rather than

ignoring the questions of others, and connecting the major planning areas of purpose, audience, and text conventions (Flower et al., 1993, p. 176).

Observation-Based Learning

Research applied explicitly and consistently to the design of classroom instruction across the range of processes from goal-setting to publication is contained in studies from the Research-for-Teaching Seminar Series at Carnegie Mellon University (Penrose & Sitko, 1993). This comprehensive collection of studies of metacognition in the college classroom is based on students' observations of ways in which they can reflect on, monitor, and control their own cognitive processes in writing. The assumption of the collection is that students can "listen in" on their own processes, discuss their observations with peers and teachers, and design for themselves more effective strategies for the classroom and workplace. Learning through self-reflection is an explicit aim of these applications of cognitive strategy research applicable to a variety of learning contexts.

A common workplace writing phenomenon that students may not experience in school is co-authoring. This special type of collaborative writing requires writers to integrate their own representations of the task, their goals, and their strategies with those of other writers. Burnett (1993) provides examples of co-authoring as collaborative decision making and argues that students can become more reflective learners and more effective collaborators if they study examples different from the immediate agreement they might seek. Self-observation provides students with alternative patterns of interaction, such as elaborating a single point, or substantive conflict generating a thorough consideration of alternatives. Reflection on the range of possibilities partners might generate can have a positive influence on the quality of decisions they make, their satisfaction with those decisions, and the quality of the documents they write.

Community Literacy Building

Theories of the social context of writing posit an interaction of readers and writers in a literacy community (Dyson & Freedman, 1991; Nystrand, 1989). Increasing attention is being given to instruction that emphasizes collaboration as a central element in the production of text. Two ongoing undertakings are Toronto's Computer Supported Intentional Learning Environment (CSILE) and Pittsburgh's Community Literacy Center.

Writing, although not the primary objective of CSILE, becomes an important element in this development of young children's learning. The creation of Scardamalia, Bereiter, and colleagues at Ontario Institute for Studies in Education, CSILE is a tool for knowledge transforming (Bruer, 1993; Scardamalia, Bereiter, McLean, Swallow, & Woodruff, 1989). It consists of an information management environment: a student-created database consisting of student work relevant to each topic being studied, electronic linking of students contributions, and a desktop publisher. Using CSILE, students are prompted to activate prior knowledge, use inquiry-based questions, and key search words to retrieve more information from the database. Students create their own links, collaborate in knowledge building, evaluate the associative links; and use language throughout to communicate with each other and with wider audiences. Measures of students' writing skills are beginning to show positive results, with essays demonstrating the knowledge transformation CSILE was constructed to encourage.

A Community Literacy Center on Pittsburgh's north side is the site of a program that explicitly applies metacognitive principles to engage both intercity youth and university students in self-reflective, strategic learning. For 9 weeks, this nonacademic context for writing hosts teenage writers, adult literacy leaders, and college writing mentors (Peck et al., 1995). The program emphasizes collaborative planning methods (Flower et al., 1993) as teens develop a 12-page document on dealing with street life. Four specific strategies are taught: collaborative planning, generating rival hypotheses, decision making by exploring options and outcomes, and revising. A literacy leader presents a 15-minute introduction to each strategy; writers and mentors try it out in pairs and groups, and reflect on its use, effectiveness, and value. Collaboration is intercultural, and, as the teens, mentors, and literacy leaders work together, their strategies for collaboration and problem solving expand to include intercultural issues, language issues, questions of authority, issues of rhetorical power (Flower, 1996). This program is an example of strategic approaches being embedded in the larger purpose of a community literacy agenda designed to support inquiry-based learning, intercultural conversation, and social change.

DOES METACOGNTION BELONG IN WRITING INSTRUCTION?

Writing is a complex activity. Learning how to write is even more complex. Skilled writers have become knowledgeable about planning, drafting, revis-

ing, and editing and are practiced in monitoring these processes, invoking them as needed throughout composing. Skilled writers have become proficient in the use of text structures as tools for generating, organizing, and revising texts. Skilled writers are aware of how their texts will function in a particular social context, and they are sensitive to the needs of their readers.

Student writers are not well practiced in controlling the complex interaction of skills required for successful composing. As they mature, and as more complex writing is required, students need regular strategy instruction in the processes of planning, drafting, revising, and editing. They need instruction in how to use appropriate text conventions and how to consider the needs of different readers. More importantly, however, as these more complex strategies are being introduced and practiced, students need regular metacognitive instruction to help them understand their own learning. Metacognitive instruction in how to monitor and control their learning will help them evaluate and integrate strategies into their own repertoire so that they can control the complex cognitive and social processes involved in producing text. Student writers who become knowledgeable about their own cognitions will be able to employ them for a variety of contextual and rhetorical purposes.

It is evident that metacognitive instruction is a natural environment for active learning in writing. It holds great promise for future research and development.

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